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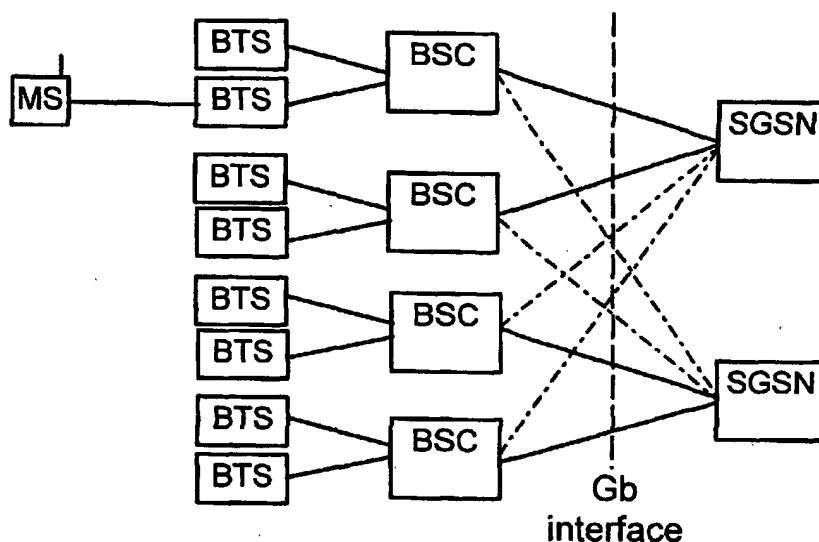
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(54) Title: **METHOD FOR HANDLING FLOW CONTROL IN PACKET SWITCHED MOBILE COMMUNICATION NETWORK**



(57) Abstract: A method related to packet switched mobile communication networks for handling flow control in core network nodes in networks using the serving node pool concept is disclosed. According to a preferred embodiment of the present invention, a BSS sets up several NSEs (Network Service Entity), one for each SGSN (Serving GPRS Support Node) to which the BSS is connected. As before, one or more NS-VS is/are set up between each of the NSEs in the BSS and the corresponding NSE in the SGSN. However, the BSS uses the same BVCI (BSSGP Virtual Connection Identifier) towards each of the SGSN in the pool to represent the same physical Radio Cell. The NSEI parameter is preferably structured in such way that one part represents the BSS side, and another part represents the SGSN side.

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METHOD FOR HANDLING FLOW CONTROL IN PACKET SWITCHED MOBILE  
COMMUNICATION NETWORK

Field of the invention

The present invention is related to packet switched mobile communication networks, in particular to handling flow control in core network nodes within such networks.

5   Background of the invention

In packet switched mobile communication networks, such as GPRS and UMTS, applications (wap/internet browsing, e-mail, LAN access etc) are provided to the users' terminals by means of so-called sessions. In the terminology of GPRS and  
10   UMTS, these sessions are referred to as PDP contexts. These PDP Contexts are activated/deactivated and handled by the SGSN currently serving the user's MS. An MS is allowed to have several simultaneously activated sessions (PDP contexts).

15   A simplified illustration of parts of a GPRS mobile telephony system is shown in Figure 1. The SGSN controls the PDP Context for the MS while the BTS and the BSC control the required radio resources.

In order to decide the current limitations for how the  
20   SGSNs and the Radio Access Network (RAN) nodes can control the traffic in one geographical area, one can look at 3GPP (3<sup>rd</sup> Generation Partnership Project, which is a standardisation organisation); Technical Specification 23.002 and 08.18. Here, some text from the circuit switched  
25   (CS) domain is also included since the description of this domain is better than the corresponding text for the packet switched (PS) domain. But, since the Mobile-services Switching Centre (MSC) in the CS domain is the analogue to the SGSN in the PS domain, this should also be applicable  
30   in the PS domain.

The Mobile-services Switching Centre is an exchange that performs all the switching and signalling functions for

mobile stations located in a geographical area designated as the MSC area.

The Base Station System (BSS) is the system of base station equipment (transceivers, controllers, etc.) which is viewed  
5 by the MSC through a single A-interface as being the entity responsible for communicating with Mobile Stations in a certain area. Similarly, in PLMNs (Public Land Mobile Network) supporting GPRS, the BSS is viewed by the SGSN through a single Gb interface (the interface between an  
10 SGSN and a BSS).

Where an Abis-interface (the interface between a BTS and a BSC) is implemented, the BSS consists of one Base Station Controller (BSC) and one or more Base Transceiver Station (BTS).

15 A Base Station Controller (BSC) is a network component in the PLMN with the functions for control of one or more BTS.

A Base Transceiver Station (BTS) is a network component that serves one cell.

A problem related to traffic flow in the Gb interface is  
20 that only one MSC, and therefore also one SGSN, is allowed to communicate with MSs in one geographical area, and therefore also within a specific radio cell. Within one radio cell, this communication is handled through one BSC and one BTS. (BSS is a logical concept, and it can contain  
25 several BSCs, where each of the BSCs is responsible for their own area.)

To control the amount of traffic an SGSN can send towards a BSC, a flow control mechanism is specified in the BSSGP (Base Station System GPRS Protocol) protocol. BSSGP is  
30 defined in 3GPP (3<sup>rd</sup> Generation Partnership Project, which is a standardisation organisation) Technical Specification (TS) 08.18 and 3GPP TS 48.018. In this downlink flow

control procedure, the BSC informs the SGSN of the allowed amount of traffic that the SGSN can send towards the BSC for each MS and for each radio cell, and the SGSN holds a mirrored image of the situation in the BSC. Until now, only  
5 one SGSN can be connected towards a BSC, as described above. The simplified picture shown in figure 2 illustrates how the flow control procedure is defined on the Gb interface, the interface between the SGSN and BSC.

In this figure, PDP Contexts 1 and 2 belongs to MS 1, and  
10 PDP Contexts 3 and 4 belongs to MS 2. For simplicity, only one radio cell is included, but the BSC can control several radio cells, where each of the radio cells is controlled by a BTS.

In order to go into more details on the use of concepts  
15 defined for the flow control procedure, the 3GPP TSs defining the Gb interface must be looked at.

3GPP TS 48.016 and 3GPP TS 48.018 describe the Gb interface. These TSs describe an option to either use the Internet Protocol (IP) for transferring messages, or to use  
20 the Frame Relay (FR) for transferring messages, but they very much use the same concepts. Therefore, the below description applies to both of them.

There is one or more Network Service Entity (NSE) at each side of the Gb interface, i.e. at the BSS and at the SGSN.  
25 This signifies that the NSE is a logical entity, and it provides a communication service to the above protocol layer, or Network Service (NS) user entity, enabling the above protocol layer to communicate with its peer. The peer-to-peer communication between remote NS user entities  
30 is performed over BSSGP Virtual Connections (BVCs).

Each Network Service Entity is identified by means of a Network Service Entity Identifier (NSEI).

The NSEI has an end-to-end significance across the Gb interface.

The NSEI is used by the BSS and the SGSN to determine the Network Service Virtual Connections (NS-VCs) that provide  
5 service to a BSSGP Virtual Connection (BVC).

An NS-VC is a communication path between an SGSN and a BSC.

A BVC is a virtual communication path between Network Service user peer entities. A BVC represents a radio cell, and it is identified by a BVCI (BVC Identifier). Since a  
10 BVCI used in the BSSGP protocol does not uniquely identify a physical radio cell, it is a logical representation of a radio cell.

The NSEI together with the BVCI uniquely identifies a BSSGP Virtual Connection (BVC) or a physical radio cell within an  
15 SGSN. Therefore, each BVCI is unique between two Network Service Entity peers.

To make one concrete example, although somewhat simplified, one can say:

A BSC is represented by an NSEI, and the SGSN will have a  
20 corresponding NSEI towards this BSC.

Between the NSEI in the BSC and the corresponding NSEI in the SGSN, one or more NS-VCs is/are connected. (In Gb over IP, an NS-VC is represented by one User Datagram Protocol (UDP) port and an IP address in the BSC, and one UDP port  
25 and an IP address in the SGSN. In Gb over FR, an NS-VC represents one FR link.)

The different radio cells, or BVCI, are then connected to the NSEI.

To summarize all the above text in a picture, Fig. 3 shows in a simplified way, how the concepts of the Gb interface are used. A comment to the figure is that the 3GPP TSs for the Gb interface do not restrict several SGSNs from  
5 accessing the same physical radio cell (since they are only dealing with the interface between the SGSN and the BSC (or the BSS)), but 3GPP TS 23.002 sets this restriction.

All the above is existing functionality. 3GPP (3<sup>rd</sup> Generation Partnership Project), which is a standardisation  
10 body, is now looking at a concept where a BSC can be connected towards several SGSNs, as shown in Fig. 4. This has several advantages, e.g. better load sharing between the SGSNs, reduced signalling in the core network, better in-service performance for the network, better scalability  
15 in the network, and easier upgrade of the SGSNs.

The dotted lines in Fig. 4 show what is new with the pool concept, i.e. that a BSC can be connected to two or more SGSNs.

When connecting several SGSNs to the same BSC and letting  
20 all these SGSNs access the same radio cell, a new aspect is added to the flow control procedure. The BSC must now control the downlink traffic from each of the SGSNs to secure that the total possible downlink traffic towards a radio cell is not violated. To avoid different  
25 interpretations by different vendors, and hence different implementation of the telecommunication equipment supplied by these vendors, it must be agreed upon how to perform this flow control procedure in an SGSN pool. Also, it should be agreed upon how to use the concepts that are used  
30 in the 3GPP TSs describing the Gb interface in an SGSN pool.

As the above-described problems are not solved by 3GPP, they are left to each vendor, and consequently, several more or less effective interpretations may appear.

**Summary of the invention**

It is an object of the present invention to provide a method that solves the problem described above. The features defined in the independent claims enclosed  
5 characterize this method.

**Brief description of the drawings**

In order to make the invention more readily understandable, the discussion that follows will refer to the accompanying drawings.

10 Fig. 1 shows a simplified illustration of parts of a GPRS mobile telephony system,

Fig. 2 shows a simplified picture of Flow Control on the Gb interface indicated in Fig. 1 in downlink direction,

15 Fig. 3 is a view of the virtual communication paths on the Gb interface according to 3GPP release 4,

Fig. 4 shows a simplified illustration of parts of a GPRS mobile telephony system when applied to a pool concept,

Fig. 5 is a view of the virtual communication paths on the Gb interface according to the present invention,

20 Fig. 6 is a view of the virtual communication paths on the Gb interface according to another aspect of the present invention.

**Description of the present invention**

The present invention provides a solution for the problem  
25 mentioned above by using (in the BSC or BSS) the existing flow control procedure on cell level (defined in 3GPP release 1999) to control each of the SGSNs in a way not to



violate the total possible traffic on a cell. Also, the existing messages within this flow control procedure should be used.

The BSC can decide to share the downlink traffic on a cell  
s between each of the SGSNs in several ways, and below some alternatives are listed.

- The possible downlink traffic can be equally shared between the SGSNs of the pool.
- 10 • The portion of each SGSN can be proportional to (or in some way be related to) the processing capacity of the SGSN.
- The portion of each SGSN can be proportional to the current traffic demands from each of the SGSNs.

When going into more details, Fig. 5 shows the preferred  
15 way of how the existing concepts on the Gb interface and in the BSSGP protocol could be used in an SGSN pool.

According to a preferred embodiment of the present invention it is suggested that:

The BSC (or BSS or Packet Control Unit (PCU)) sets up  
20 several NSEs, each identified by a separate NSEI, and where the NSEs go towards one SGSN each, and all of the NSEs then together are connected towards all the SGSNs in the pool. As an alternative, several NSEs in the BSC (or BSS or PCU) are connected towards each of the SGSNs. One or more NS-VC  
25 is/are then set up between each of the NSEs in the BSC (or BSS or PCU) and the corresponding NSE in the SGSN, as before. The identity of the NS-VC is unique within an NSEI.

The BSC (or BSS or PCU) uses the same BVCI value towards  
each of the SGSNs in the pool to represent the same  
30 physical radio cell.

Each of the NSEIs (alternatively, all the NSEIs going from one BSC (or BSS) towards one SGSN) can either be connected to one Packet Control Unit (PCU) each, or all the NSEIs covering the same geographical area can be connected to the same PCU.

The NSEI parameter (alternatively a new parameter substituting the NSEI, or a new parameter used together with the NSEI) could be structured in such a way that one part represents the BSC side (or the like, e.g. BSS or PCU), and another part represents the SGSN side. In this way, the NSEI parameter will give uniqueness on the Gb interface over several BSCs (or BSS or PCU). By doing so, each of the NSEIs in Fig. 5 can even be located in different BSCs (or BSSs or PCUs).

Fig. 6 shows a second embodiment of the present invention. This is a way of how the existing concepts on the Gb interface and in the BSSGP protocol could be used in an SGSN pool.

According to this embodiment, the BSC (or BSS or PCU) sets up one common NSE, and this is going towards each of the SGSNs in the pool. In other words, for a specific cell, all the SGSNs see the same NSEI. One or more NS-VC(s) is/are then set up between the NSE in the BSC (or BSS or PCU), and the corresponding NSEs in the SGSN, as before. (As an alternative, the BSC (or BSS or PCU) sets up several NSEs, and all of them are going towards each of the SGSNs in the pool).

The BSC (or BSS or PCU) uses the same BVCI value towards each of the SGSNs in the pool to represent the same physical radio cell.

One disadvantage with this proposal compared to the preferred alternative described above, is that the NSEI

parameter is no longer unique over the Gb interface in the uplink direction (from the BSC (or BSS or PCU) to SGSN).

The present invention specifies how the flow control procedure should be done, as well as how to use the  
5 concepts on the Gb interface, when introducing SGSN pools. Therefore, this will avoid different interpretations by different vendors, and hence different implementation of the telecommunication equipment supplied by these vendors.

The preferred alternative of the present invention  
10 (described in Fig. 5) also has the advantage of keeping an end to end significance for the NSEI parameter over the Gb interface when introducing the pool concept in a GPRS network. This further has the advantage of simplifying the configuration and implementation of the Gb interface  
15 functionality.

Abbreviations

	RAN	Radio Access Network
	3GPP	3 <sup>rd</sup> Generation Partnership Project
	CS	Circuit Switched
5	PS	Packet Switched
	MSC	Mobile-services Switching Centre
	BSS	Base Station System
	SGSN	Serving GPRS Support Node
	PLMNs	Public Land Mobile Network
10	Gb interface	the interface between an SGSN and a BSS
	Abis-interface	the interface between a BTS and a BSC
	BSC	Base Station Controller
	BTS	Base Transceiver Station
	QoS	Quality of Service
15	MS	Mobile Station
	IP	Internet Protocol
	FR	Frame Relay
	NS	Network Service
	BVCs	BSSGP Virtual Connections

	NSEI	Network Service Entity Identifier
	NS-VCs	Network Service Virtual Connections
	BVC	a BSSGP Virtual Connection
	NS-VC	communication path between an SGSN and a BSC
5	BVC	a virtual communication path between Network Service user peer entities
	BVCI	BVC Identifier
	BVC	BSSGP Virtual Connection
	UDP	User Datagram Protocol
10	NSE	Network Service Entity
	NSEI	Network Service Entity Identification
	PCU	Packet Control Unit

References

- [1] 3GPP overall architecture. 3GPP TS 48.016
- [2] 3GPP overall architecture. 3GPP TS 48.018
- [3] 3GPP overall architecture. 3GPP TS 23.002
- 5 [4] 3GPP overall architecture. 3GPP TS 08.18

## P a t e n t   c l a i m s

1. Method in a packet switched mobile communication network comprising Base Transceiver Stations (BTSS) each associated with one or more radio cells each identified by  
5 a cell identifier, a Base Station System, Base Station Controller or Packet Control Unit (BSS/BSC/PCU) or a similar node or unit controlling one or more BTSS, and serving nodes each being able to serve the BSS/BSC/PCU, wherein each connection between the serving nodes and the  
10 BSC is provided by a virtual connection between two virtual entity peers, one associated with the BSS and one with the respective serving node,  
c h a r a c t e r i z e d   i n
- 15 a) establishing one or more virtual entities for each serving node in the BSS/BSC/PCU, each identified by a virtual entity identifier unique for the respective serving nodes,
  - b) establishing one or more virtual connection for each virtual entity established in a),
  - 20 c) representing a certain radio cell towards all the serving nodes using the same cell identifier.
2. Method according to claim 1,  
c h a r a c t e r i z e d   i n   t h a t   c o m m u n i c a t i o n   b e t w e e n   t h e   B S S   a n d   t h e   s e r v i n g   n o d e s   i s   i m p l e m e n t e d   b y   a   G b  
25 i n t e r f a c e   a n d   a c c o r d i n g   t o   a   B S S G P   p r o t o c o l   w h e r e i n   t h e   c e l l   i d e n t i f i e r s   a r e   B C V I s ,   t h e   v i r t u a l   e n t i t i e s   a r e   N S E s ,   t h e   v i r t u a l   e n t i t y   i d e n t i f i e r s   a r e   N S E I s ,   a n d   t h e   v i r t u a l   c o n n e c t i o n s   a r e   N S - V C s .
3. Method according to claim 1 or 2,  
30 c h a r a c t e r i z e d   i n   t h a t   s a i d   s e r v i n g   n o d e s   a r e   S G S N s   i n   a   G P R S   n e t w o r k .

4. Method according to one of the claims 1-3,  
c h a r a c t e r i z e d i n the following additional  
step:

- distributing downlink traffic to the BSS equally  
5 between the serving nodes.

5. Method according to one of the claims 1-4,  
c h a r a c t e r i z e d i n the following additional  
step:

- distributing downlink traffic to the BSS/BSC/PCU so  
10 that a portion of the downlink traffic going through a  
certain serving node is proportional to a processing  
capacity of that serving node.

6. Method according to one of the claims 1-5,  
c h a r a c t e r i z e d i n the following additional  
15 step:

- distributing downlink traffic to the BSS/BSC/PCU so  
that a portion of the downlink traffic going through a  
certain serving node is proportional to current  
traffic demands from that serving node.

20 7. Method in a packet switched mobile communication  
network comprising Base Transceiver Stations (BTSS) each  
associated with one or more radio cells each identified by  
a cell identifier, a Base Station System, Base Station  
Controller or Packet Control Unit (BSS/BSC/PCU) or a  
25 similar node or unit controlling one or more BTSSs, and  
serving nodes each being able to serve the BSS/BSC/PCU,  
wherein each connection between the serving nodes and the  
BSS/BSC/PCU is provided by a virtual connection between two  
virtual entity peers, one associated with the BSS/BSC/PCU  
30 and one with the respective serving node,  
c h a r a c t e r i z e d i n



- a) establishing one single virtual entity in the BSS,
- b) establishing one or more virtual connection for each serving node wherein the single virtual entity established in a) is the common virtual entity peer associated with the BSS/BSC/PCU for all the virtual connections,
- c) representing a certain radio cell towards all the serving nodes using the same cell identifier.

8. Method according to claim 7,  
c h a r a c t e r i z e d i n that communication between the BSS and the serving nodes is implemented by a Gb interface and according to a BSSGP protocol wherein the cell identifiers are BCVIs, the virtual entities are NSEs, the virtual entity identifiers are NSEIs, and the virtual connections are NS-VCs.

9. Method according to one of the claims 7 or 8,  
c h a r a c t e r i z e d i n that said serving nodes are SGSNs in a GPRS network.

10. Method according to one of the claims 7-9,  
c h a r a c t e r i z e d i n the following additional step:

- distributing downlink traffic to the BSS/BSC/PCU equally between the serving nodes.

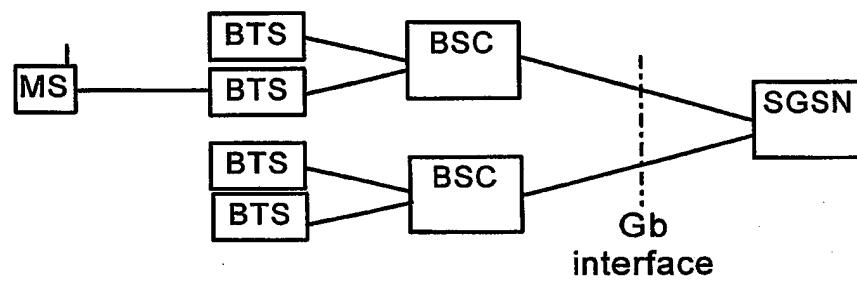
11. Method according to one of the claims 7-10,  
c h a r a c t e r i z e d i n the following additional step:

- distributing downlink traffic to the BSS/BSC/PCU so that a portion of the downlink traffic going through a certain serving node is proportional to a processing capacity of that serving node.

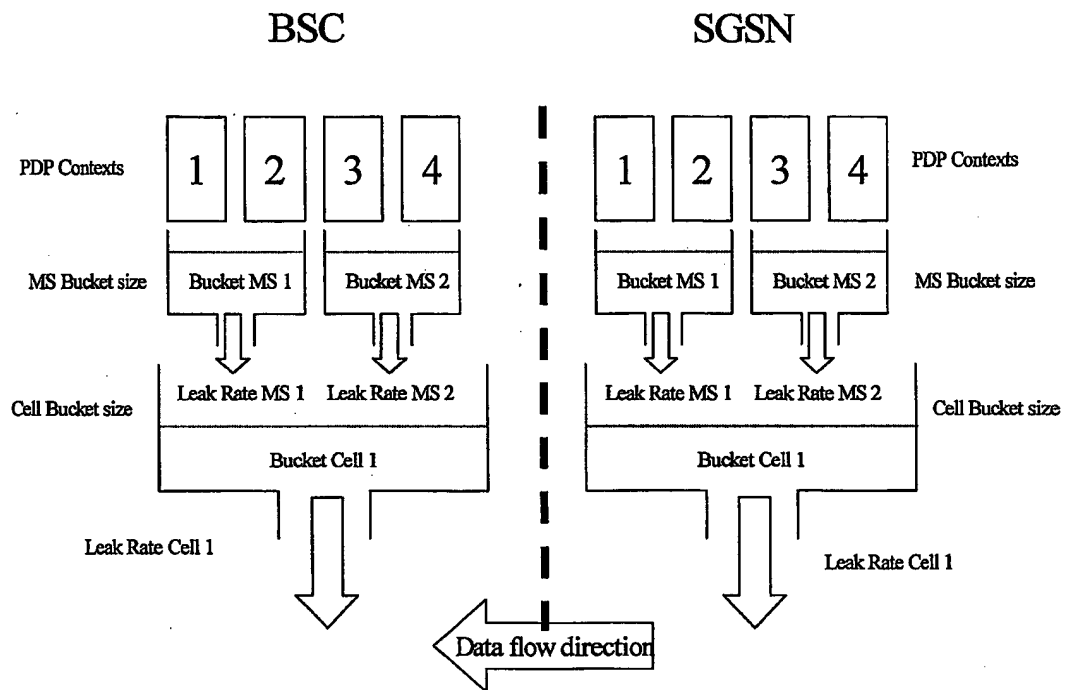
12. Method according to one of the claims 7-9,  
c h a r a c t e r i z e d i n the following additional  
step:

- distributing downlink traffic to the BSS/BSC/PCU so  
5 that a portion of the downlink traffic going through a  
certain serving node is proportional to current  
traffic demands from that serving node.

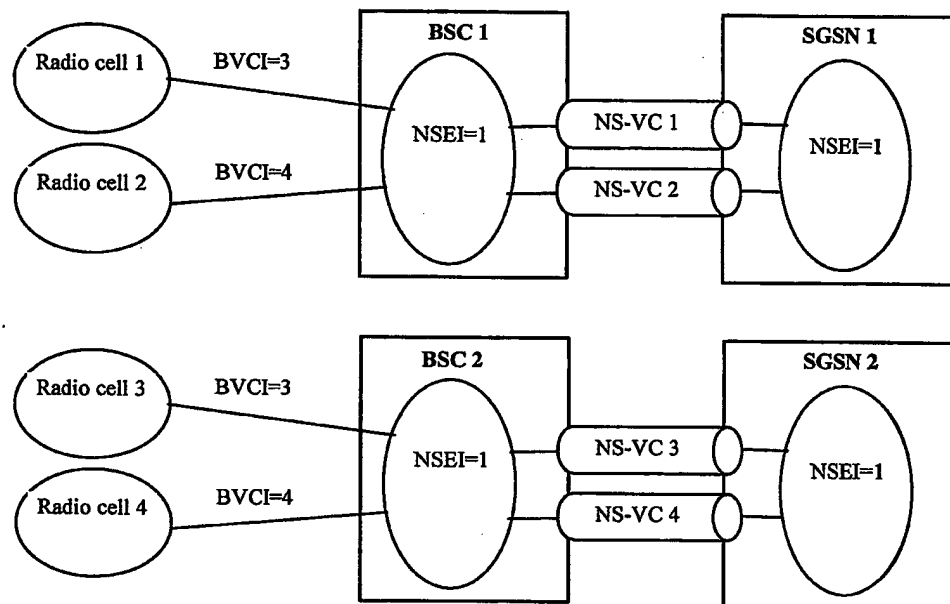
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**Fig. 1**

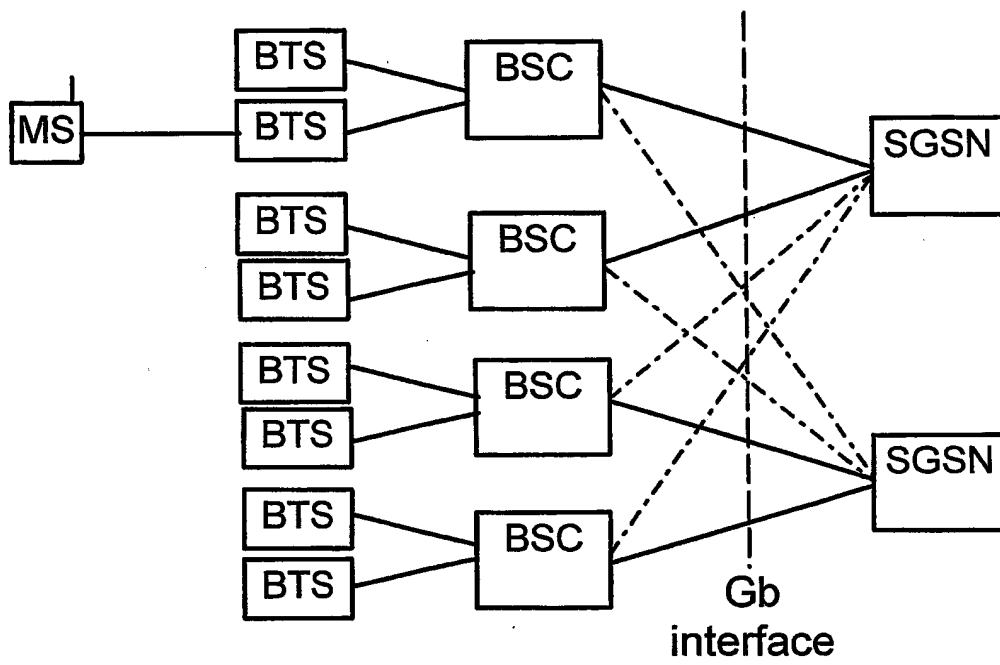
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**Fig. 2**

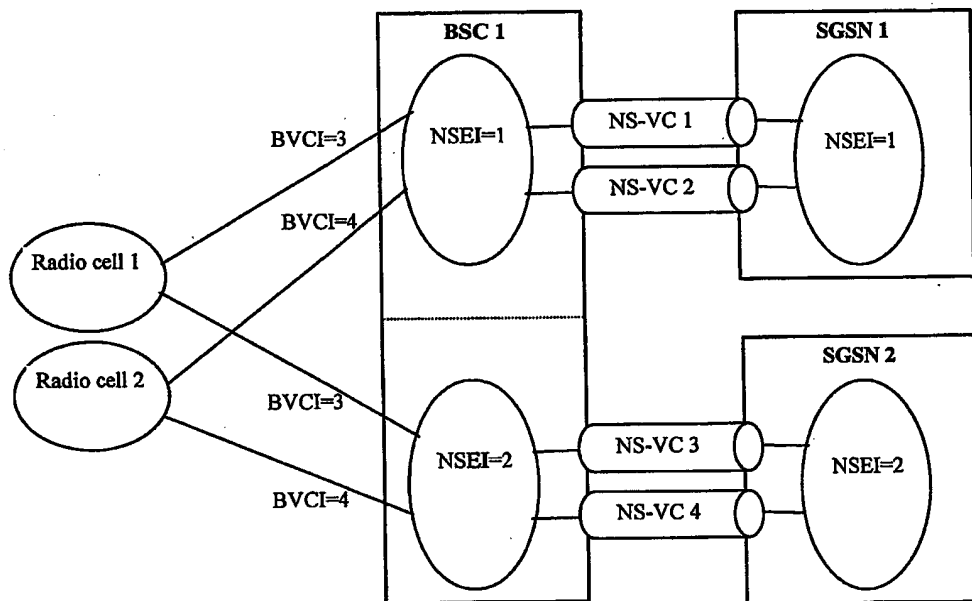
3/6

**Fig. 3**

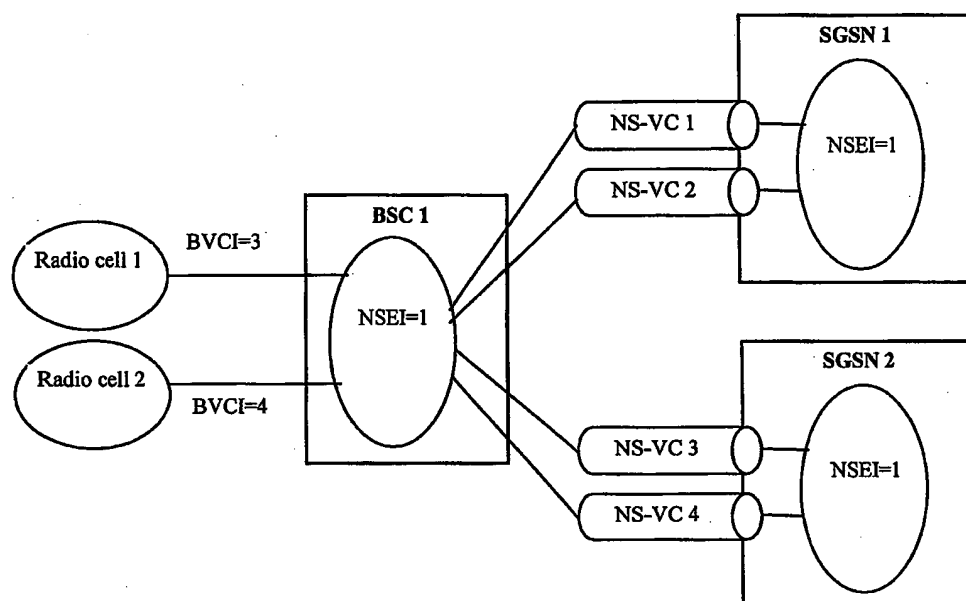
4/6

**Fig. 4**

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**Fig. 5**

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**Fig. 6**



## INTERNATIONAL SEARCH REPORT

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## A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

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